GEI Consultants

Geotechnical
Water Resources
Environmental and
Ecological Services

Surface Water Management Plan

Waimanalo Gulch Sanitary Landfill

Submitted to:
Waste Management of Hawaii, Inc.
92-460 Farrington Highway
Kapolei, Hawaii 96707

Submitted by:
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Project 07018-1

WMH 000603

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1.0 Introduction

This Surface Water Management Plan (SWMP) was prepared for the Waimanalo Gulch Sanitary Landfill (Landfill) which is located at 92-460 Farrington Highway in Kapolei, Oahu, Hawaii. The document is an update of the SWMP prepared by AECOM [2009].

The Landfill is owned by the City and County of Honolulu (CCH) and operated by Waste Management of Hawaii, Inc. (WMH). This SWMP was prepared in accordance with Hawaii Administrative Rules (HAR) Title 11, Chapter 58.1, and Special Condition G of the Landfill solid waste permit (No. LF-0182-09), dated 4 June 2010, issued by the Solid and Hazardous Waste Branch of the Hawaii Department of Health (HDOH).

1.1 Purpose of Surface Water Management Plan

The purposes of the SWMP are:

a. To describe the design basis and storm used to estimate surface water run-on and run-off at the Landfill.
b. To describe the surface water management features, including permanent and interim, to direct and manage surface water run-on and run-off at the Landfill.

Other requirements in the solid waste facility permit[1] are:

General

- Bypass site run-on and collection and control of site run-off from a 24-hour storm, 25-year;
- Minimize soil erosion and exposure of waste due to soil erosion; and
- Prevent discharge of pollutants into waters of the United States (U.S.), or violation of any requirement of the Clean Water Act (CWA) or statewide water quality management plan.

Specific

- A western bypass channel or offsite surface water conveyance for the upper Waimanalo Gulch and western area flows, in accordance with construction drawings titled *Western Surface Water Drainage Project*, dated January 2010 and prepared by GEI Consultants, Inc. This conveyance is designed to handle the 24-hour, 25-year storm flows, and will

[1] Refer to Solid Waste Management Permit No. LF-0182-09 dated 4 June 2010 for the complete details.

bypass the landfill and terminate in a stilling basin to be constructed below (i.e., to the South) the existing sedimentation basin.

- An on-site surface water management system designed for the 24-hour, 25-year storm that includes: (i) temporary berms, swales, and pipes as necessary to prevent ponding and minimize infiltration of stormwater into the landfill, and (ii) construction of the Eastern Surface Water drainage system.

This SWMP will be updated to address changes in the flow patterns resulting from landfilling operations and to verify the adequacy of the on-site drainage measures.

1.2 Regulatory Background

1.2.1 Solid Waste Regulations

Solid waste regulation HAR 11-58.1-15(g) provides requirements to ensure adequate control of storm water events at landfills. The regulation requirements for run-on or run-off control systems and surface water management are listed below.

Requirements for run-on or run-off control systems

Owners or operators of all MSW landfill units must design, construct, and maintain the following:

- A run-on control system to prevent flow onto the active portion of the landfill during the peak discharge from a 24-hour, 25-year storm.
- A run-off control system from the active portion of the landfill to collect and control at least the water volume resulting from a 24-hour, 25-year storm.
- Run-off from the active portion of the landfill unit must be handled in accordance with surface water requirements.

Furthermore, the surface water run-on conveyances at the Landfill have been evaluated to reduce potential impacts to the Landfill area during peak flow resulting from the 24-hour, 100-year storm.

For reference, the 24-hour, 25-year storm at the landfill is about 9.0 inches and the 24-hour, 100-year storm is about 11.5 inches as determined by point precipitation frequency estimates from the NOAA Atlas No. 14 precipitation frequency data server (http://hdsc.nws.noaa.gov)

Requirements for surface water management

MSW landfill units shall not:

- Cause a discharge of pollutants into waters of the U.S., including wetlands, that violates any requirement of the CWA, including, but not limited to, the National Pollutant Discharge Elimination System (NPDES) requirements, pursuant to Section 402 of the CWA.

- Cause the discharge of a non-point source of pollution to waters of the U.S., including wetlands, that violates any requirement of an area-wide or state-wide water quality management plan that has been approved under Sections 208 or 319 of the CWA, as amended.

1.2.2 National Pollutant Discharge Elimination System

The CCH was issued a Notice of General Permit Coverage (NGPC) for the Landfill under NPDES on August 30, 2010, which was assigned File No. HI R50A533. Under the Landfill's NGPC, the CCH, Department of Environmental Services is authorized to discharge storm water run-off associated with industrial activity at the Landfill to the receiving State water named the Waimanalo Gulch stream. The activities associated with the Landfill NGPC are described in the Landfill Storm Water Pollution Control Plan (SWPCP), which was written to comply with this regulation and was originally submitted to the Clean Water Branch of the HDOH in 2005. The SWPCP is evaluated as often as needed to comply with the condition of the NGPC and is included in the Site Operations Manual [WMH 2009] that was previously submitted to HDOH.

The SWPCP was updated in 2009 to reflect on-site changes [Earth Tech 2009a] and re-submitted to HDOH.

1.2.3 Spill Prevention, Control, and Countermeasures Plan.

A Spill Prevention, Control, and Countermeasures (SPCC) Plan was developed for the Landfill by Earth Tech [2009b] and is included in the Site Operations Manual [WMH 2009] that was previously submitted to HDOH. The SPCC Plan complies with Title 40 Code of Federal Regulations Part 112 and addresses measures for prevention and control of fuel and oil related spills.

2.0 Site background

This section presents a summary description of the Landfill including its location, size, elevation, and limits, and surrounding area.

2.1 Site Description

The Landfill is located at 92-460 Farrington Highway in Kapolei, on the southwest side of the island of O`ahu, Hawaii. The site is approximately 15 miles northwest of Honolulu International Airport and two miles southeast of Nanakuli, as shown on Figure 1. The facility occupies a portion of a rugged, southwest-sloping coastal canyon (Waimanalo Gulch) and extends approximately 1.2 miles up-canyon (northeast) from Farrington Highway as shown on Figure 2. The landfill office and scale house are located at the southern end of the facility, near Farrington Highway.

The Landfill property encompasses a total of 200 acres, of which approximately 116 acres is the landfill footprint. The site is long and narrow, approximately 7,000 feet in length, with a width ranging from 820 feet on Farrington Highway frontage to about 1,900 feet at the widest point. The landfill entrance at Farrington Highway is approximately 60 feet above mean sea level (msl), and the extreme northeast corner of the property is at an elevation of 990 feet above msl.

2.2 Climate and Topography

The Landfill is located in a region of Oahu that is relatively arid when compared to the rest of the island due to the "rain-shadow" effect of the Waianae Mountain Range. Average annual rainfall in the area is approximately 19 inches, while stations in nearby mountains experience significantly higher rainfall averages (Hokuloa gauge, elevation 2,200 msl, average annual rainfall 42 inches).

Prevailing winds in the area of the landfill are the Hawaiian trade winds, which are channeled along the Nanakuli coastline by the Waianae and Ko`olau Mountains, in a roughly northeast to southwest direction, at an average annual speed of approximately 10 knots. Between the months of October and April, the Landfill occasionally comes under the influence of southerly winds associated with Kona storms or approaching storm fronts.

Typical daily temperatures range from the low 60s (degrees Fahrenheit [°F]) to the upper 70s °F during the winter and from the lower 70s °F to the upper 80s °F during the summer.

The regional topography near the landfill is dominated by the moderate to steep Waianae Range, a northerly trending volcanic mountain range that is characterized by narrow valleys, separated by steeply sloping hills and ridges. The range extends northward from the site approximately 20 miles. The Landfill is located at the southern toe of this range in a typically narrow valley (gulch). Elevations along the main mountain ridgeline range from about 1,000 to 4,000 feet msl. Elevations drop dramatically away from the main ridgeline. Lateral slopes along the Waianae Range are asymmetrical, with steeper slopes to the west. Typical slopes on the sides of the range drop some 2,600 feet over distances of two miles or less. Near the Landfill, the mountains of the Waianae Range transition to the low-lying coastal plains.

2.3 Surrounding Area

The Landfill is surrounded by open space to the north and west. The Hawaiian Electric Company (HECO) Kahe Power Generating Station is located west of the Landfill's boundary. The Ko`Olina Resort is south of the Landfill.

3.0 Surface Water Management Plan

The Landfill consists of 8 original cells where ash is disposed (Ash Cells 1 through 8), one future cell where ash will be disposed (Cell E8), and 15 cells where municipal solid waste (MSW) is/was disposed (MSW Cells 1 through 3; MSW Cells 4A, 4B, and 4C; MSW Cells 5 through 11; and MSW Cells E1 through E4), and 5 cells (E5 through E9-under development) which constitute the recent expansion approved by Solid Waste Management Permit No. LF-0182-09. The fill slopes are equal to or flatter than 3:1 (horizontal to vertical) and the maximum elevation reached will be approximately 810 feet msl. Figure 3 shows the main surface water management systems that will be used to control surface water run-on and run-off:

a. Western Bypass to control stormwater run-on from the upper Waimanalo Gulch and western areas adjacent to the Landfill that do not come in contact with the Landfill. This system will also convey run-on water flowing from the Northern Drainage System.

b. Western Drainage System. This system will convey flows from the western side of the landfill and will be collected in a down drain and pipe conveyance system which discharges to the site's sedimentation basin.

c. Eastern Drainage System to convey flows from the eastern and south sides (both onsite run-off and offsite run-on).

Figure 3 also shows a schematic of the major temporary and permanent drainage features associated with each system. Temporary and permanent drainage features are presented in more detail on Figures 5 and 6. The temporary features will be in service as MSW and ash placement proceeds in the Cell E5 through E9 area. These features will be modified or taken out of service as fill grades are raised in the landfill and areas of the landfill are closed as illustrated in Figure 4. Temporary landfill drainage flows conveyed through these features will report to the on-site sedimentation basin.

Permanent surface water management features will control site run-on and landfill run-off as the Cell E6- E8 area is expanded and will also be in place after the landfill is closed. The perimeter run-on controls (i.e. the Western and Eastern Drainage Systems) are permanent surface water management features. The Eastern Drainage system will be extended to the north into the Cell E6-E9 area. There will also be permanent drainage ditches and drop inlets to covey landfill run-off flows and perimeter run-on flows into permanent on-site management systems. Permanent drainage ditches will also convey flows directly into a concrete lined channel immediately upstream of the sedimentation basin.

The remainder of this section describes in more detail the various temporary and permanent surface water management features at the Landfill.

3.1 Temporary Surface Water Management Features

As the Landfill is further developed (i.e., filled), the stormwater run-off will be directed toward the South and West. Figure 5 shows the initial fill sequencing plan.

A majority of the storm water flows will be diverted around the periphery of the landfill by the Western Bypass described previously; however, run-off will also be generated downstream of these systems during the period of active landfilling.

3.1.1 Western Drainage System

The Western Drainage System will convey run-on flows from the western perimeter access road and run-on flows from landfill grades in the Cell E6 though E8 area. Figure 5 shows the key components of the Western Drainage System. The run-on flows from western perimeter access road will be directed towards the permanent inlet located in the West Berm area. Run-off flows from the landfill will either be directed into an 18-inch down drain system or surface water ditches described below.

The western drainage system includes a 36-inch-diameter HDPE temporary diversion pipe that will convey storm water flows from areas to the north of cells E6 through E9. The 36-inch pipe conveys flows to the existing concrete channel and sedimentation basin located at the south end of the landfill. Some of the interior drainage pipes and inlets will be decommissioned as the landfill is developed.

Figure 3 shows a schematic of how the ditches and pipes convey surface water run-on and run-off flows from the northern part of the landfill to the existing sedimentation basin located to the south of the landfill. Key features of the interior drainage system are as follows:

- Surface water run-off from the Landfill will be collected by temporary lined ditches along the western side of the Landfill which will flow to 18-inch drainage pipe drop inlets.

- Surface water run-off the unlined slopes will be collected on the benches by ditches which will also flow into the drop inlets.

- The drop inlets flow into an 18-inch-diameter HDPE buried pipe which discharges into a 36-inch-diameter HDPE buried pipe which in turn discharges to the sedimentation basin at the south end of the landfill. For reference, portions of the top surface of the West Berm will be graded as needed to direct flow to the drop inlets; the drop inlets will be extended or decommissioned depending on the field conditions.

- If the flow capacity of an individual inlet is exceeded, the surface water will be conveyed to the sedimentation basin by open rock-lined ditches. Refer to Figure 5 showing the downstream conveyance routes of the landfill surface water (i.e., through the 36-inch HDPE pipe or the rock-lined ditches). The open ditches will run alongside the landfill access road and convey flows downstream to the existing concrete channel and sedimentation basin.

Surface water run-off from the currently unlined slopes located to the North of Cell E8 will flow into an inlet that enters a 36-inch-diameter HDPE buried pipe below the liner (i.e., the temporary E8/E9 inlet shown on Figure 5). This inlet will remain active as the Landfill is developed; furthermore, as Cell E9 is developed, the 36-inch HDPE pipe may be extended to the north and up the slope and the inlet would be relocated. The pipe and the inlet will be properly abandoned when the landfill reaches the perimeter road/bench.

If needed, operations will also deploy pumps that would pump any accumulated water that has not been in contact with MSW or ash to the ditches that flow to the sedimentation basin. Water that has been in contact with MSW or ash will be pumped and transported to the publicly-operated water treatment works (POTW).

3.1.2 Eastern Drainage Phase 1 Inlet

The Eastern Drainage System will intercept eastern storm water runoff and run-on and convey it in a primary and an auxiliary pipe system. Collected water will be discharged to the existing sedimentation basin located near Farrington Highway. The Eastern Drainage System will be constructed in two phases: Phase I and Phase II as shown on Figures 5 and 6.

The Phase I pipe conveyance extends approximately 3,500 feet upstream from the existing sedimentation basin. The inlet structure at the upstream end of Phase I will be active for a few years until the Phase II extension of the pipe conveyance towards the north is required. Temporary drainage ditches will convey drainage from the eastern portion of the site towards the inlet at the upstream end of Phase I. The Phase I inlet is expected to serve until the elevation of the landfill reaches the same elevation as the Eastern Perimeter Bench. At this time the Phase II portion of the system will be constructed and landfill run-off on the east side will be captured in the permanent ditches and inlets associated with the Eastern Drainage System.

3.1.3 Landfill Ditches

The ditches on the landfill will be moved as landfilling activities progress and subsequent cells are constructed. Generally, as shown on Figures 3, 4 and 5, the objective for the landfill areas and the future landfill is to drain the areas to the west and to the south so that the flows report to the sedimentation basin. The runoff from areas of the landfill that have not been fully-developed (e.g., the slopes that have been excavated but not lined to receive waste) will be captured by ditches on the benches on the rock cut-slopes that will also flow to drop inlets of the interior drainage system or to other ditches that will convey flow to the sedimentation basin. The above components are described in Section 3.2, Permanent Drainage Features

The open ditches along the western side of the landfill will be lined with sacrificial geomembrane to minimize erosion and minimize water seeping into the landfill. Figure 3 presents the proposed configuration of the temporary ditches as MSW grades are raised. Open ditches in non-active landfilling areas, and the landfill access road will be rock lined. Inlets and down drains will consist of HDPE basins and pipes with typical diameters ranging from 18-inches to 36-inches. The location of key conveyance ditches, inlets and down drains is presented on Figure 5.

3.1.4 Landfill Stockpile Drainage

The landfill stockpile will be used to store excavation spoils from the excavations for the landfill, and will have the approximate footprint shown on Figure 5. The stockpile will be depleted and expanded (to the maximum configuration shown), depending on future landfill and construction operations. As part of the interim surface run-on and run-off measures, the stockpile will be graded so that surface water runoff flows to the south towards the Sedimentation Basin. Best management practices such as hydroseeding and wattle/erosion control mat installation will be used to control erosion as needed.

3.2 Permanent Surface Water Management Features

This section describes the various surface water management components that will be permanent features. Many of the perimeter run-on control features will be in-place while the landfill is active but may also remain in-place after the landfill is closed.

3.2.1 Western Bypass System

The system is designed to divert the 24-hour, 25-year storm event run-on collected from the upper part of the Waimanalo Gulch, located north of the permitted landfill footprint, and convey the stormwater flow under gravity flow conditions around the western perimeter of the landfill. There are also contingency measures in place to control a 24-hour, 100-year event and prevent water entry into the landfill area. These control measures will be installed along the upper perimeter access road and include a 2-foot high berm along the eastern (landfill side) and a drainage ditch on the rock cut slope side to direct flows southward. The upper perimeter access road steepens to a 20 to 30 percent grade near the southern end of the landfill expansion area. In order to minimize the potential for erosion and scour along the access road in this steep area, water will be conveyed downstream to the west berm inlet via a 36-inch diameter HDPE pipe along the perimeter access road. (Refer to Figures 5 and 6). Intercepted runoff along the steep portion of the bench will enter the pipe via grated catch basins.

The system will also receive diverted run-on flows from the abandoned Nike site conveyed through the Northern Channel Diversion system as described in Section 3.2.2. The main conveyance components of the Western Bypass System are (from north to south):

- A concrete diversion and concrete channel transition structure to intercept flows from Waimanalo Gulch;
- A 1,200 feet long concrete box culvert structure, having a cross section dimension of 10-feet by 10-feet;
- A buried, fiberglass mortar pipe (HOBAS pipe) conveyance with diameters varying from 104 inches to 78 inches with a total length approximately 5,200 feet; and
- A stilling basin (flip bucket and plunge pool) at the downstream end of the pipe that discharges to the existing channel and Farrington Highway culverts.

<u>Diversion Structure</u>. The diversion structure consists of a 100-foot-long reinforced concrete, side-channel weir structure having minimal submergence. The weir structure will trap some coarse sediment upstream of the HOBAS pipe especially during storms; the structure will be cleaned out as needed. Low flows from the upper Waimanalo Gulch will be discharged at a slow rate through the 12-inch-diameter pipe outlet installed across the weir at side channel invert level to minimize ponding and convey the flows to the box culvert.

<u>Box Culvert and Pipe Conveyance</u>. The 10-foot by 10-foot buried box culvert segment of the Western Surface Water Drainage conveyance begins at the downstream end of the diversion structure and extends southeast (see Figures 5 and 6). The box culvert is approximately 1,200 feet long, and has a relatively flat grade of approximately 0.6%. A coarse sediment trash rack is installed at the upstream end of the box culvert structure. The box culvert has an average burial depth of approximately 3 feet below the final landfill bench grade. The downstream end of the box culvert connects from the rectangular cross section to the circular HOBAS pipe section through a concrete transition structure. The pipe conveyance system will bypass the sedimentation basin and discharge to the stilling basin.

<u>Flip Bucket Structure and Plunge Pool</u>. The pipe alignment makes an eastward turn to direct the flow towards a plunge pool with a flip bucket structure (stilling basin). The stilling basin

provides gravity flow downstream to the existing drainage culverts beneath Farrington Highway. The bottom of the stilling basin will be lined with large size rock riprap to limit erosion. Low flow outlets from the plunge pool are provided by two 48-inch diameter pipes crossing the dike forming the southwest end of the plunge pool. The discharge capacity of the two 48-inch pipes will only be adequate to discharge low flows and at high flow, the water depth in the pool will rise to flow over the dike crest.

3.2.2 Northern Drainage Diversion

This system will be constructed along the northern property boundary above the future Landfill area to divert and convey flows up to the 24-hour, 100-year storm run-on collected from a drainage swale at the northern property boundary of the site. The diverted storm water will be conveyed to the southwest beneath the future Cell E9 cut slope boundary, and discharge into the Western Drainage diversion structure.

The total elevation drop is about 150 feet. The main components are:

- A diversion structure consisting of a concrete inlet with sloping trash rack and a rock fill diversion berm to direct flows from the upstream swale area.
- A 36-inch diameter, 750 foot-long HDPE pipe to convey flows southwest in a steep gradient area above the diversion weir for the Western Drainage System. The 36-inch HDPE pipe will discharge directly into the side channel invert of the diversion structure.

3.2.3 Permanent Portion of the Western Drainage System

The downstream segment of the 36" HDPE pipe (i.e. the portion in the existing concrete channel) will remain active to receive drainage from the western perimeter access road and landfill areas. A 36-inch stubbed- out "Y" connection was added to the drainage alignment in the West Berm area to convey future surface water flows from landfill areas on the north and west side of the landfill downstream to the sedimentation basin. A drainage inlet will be installed at the northern end of the west berm buttress to collect upstream surface water from landfill areas. The system is sized to convey flows resulting from the 24-hour, 25-year event.

When the final stockpile configuration is achieved, permanent down drains and ditches may be installed prior to landfill closure. Preliminary configurations of drainage control features in the stockpile area are shown on Figure 6.

3.2.4 Eastern Drainage System

Phase I of the Eastern Drainage System will function to receive upstream flows from temporary drainage benches and a temporary upstream inlet as the eastern side of the landfill is developed. However, the Phase I system will also receive run-on and run-off including drainage from landfill areas and the eastern cut slopes above the perimeter access road. Phase II will include 2,900 feet of pipe to collect and convey runoff from the landfill (Figure 6). The combined drainage area for the Phase I and II systems will be approximately 50 acres. Phase II will be installed as the landfill is developed.

At the southeast end of the landfill, runoff from a catchment area of about 11 acres will be collected in an auxiliary drainage system as shown on Figures 5 and 6.

The temporary inlet for the Phase I portion of the system is described in Section 3.1. The permanent features of the Eastern Drainage System will include the following:

<u>Upstream Inlet Structure</u>- The Phase II inlet will be designed as a permanent structure. Each inlet structure have an approach channel, debris barrier, coarse trash rack, and transition from open ditch to pipe section.

<u>Pipe Conveyance</u>- A 36-inch-outer-diameter HDPE pipe will be used for the main conveyance pipe in the Phase I and II systems. The pipe will be buried along the eastern perimeter of the landfill. The pipe conveyance will follow along the alignment of the final landfill closure cap, except for the downstream 1,300 feet that will be located along the existing landfill access road.

<u>Structures along Pipe Conveyance</u>- Along the pipe alignment a V ditch on the landfill side of the bench serve to intercept runoff from the landfill slopes facing east and from the narrow drainage area along the other west-facing, side of the bench. Intercepted runoff along the bench enters the pipe via grated catch basins connected to the main conveyance pipe. Depending on the elevation, catch basins will be placed at 100- to 300-ft horizontal (N-S) intervals. The catch basins in Phase I will also collect surface run-on from drainage bench areas above active areas of the landfill, and surface runoff from the existing landfill Manholes, air vents, and pipe anchors will also be included as needed.

<u>Outlet Structure</u>- The outlet structure is planned to be an energy dissipater structure. Considering that the sedimentation basin may not always contain water to cushion and to dissipate the energy of the outflow, an impact type energy dissipater which does not require tail water was selected.

<u>Auxiliary Drainage System</u>- At the southeast area of the landfill, run-off from the landfill access road and ash berm areas will be collected and conveyed in a separate 18-inch HDPE pipe, about 1,400 feet long that collects surface water by gravity and discharges it to the sedimentation basin. The pipe will be routed along the existing access road. Runoff from the up gulch side of the

perimeter access road and the nearby landfill slope is diverted to the inlets along the auxiliary pipe conveyance.

Truck Scale, Parking Lot, and Flare Station Drainage- The truck scale area is located at the lower end of the existing landfill disposal area, to the east of the sedimentation basin. Currently the runoff from the paved truck scale area drains into a ditch formed along the east side of the truck scale area. The ditch conveys drainage flow from the truck scale area to a natural flow line further southeast. At this time, the configuration envisioned for diverting drainage runoff from the truck scale area into the sedimentation basin involves: capturing of the southern ditch flow in a drop inlet and conveying water beneath the Landfill office parking lot into the sedimentation basin with an HDPE cross drain. Surface ditches will also intercept runoff from the Flare Station and entrance road areas as shown on Figures 5 and 6. An inlet will also be constructed in the parking lot area, to convey surface water collected in the parking lot to the HDPE cross drain. An oil-water separator will be installed at the downstream end of the cross drain before it enters the sedimentation basin to remove any oils or fuels that enter into the system from the parking lot, access road flare station or truck scale areas.

3.2.5 Sedimentation Basin

The sedimentation basin is located by the landfill's entrance facilities (Figures 3, 5 and 6) and receives the run off flows from the landfill to allow for sedimentation and gradual release of storm water up to the 1 inch design storm (per the City and County of Honolulu's Storm Drainage Standards). The outlets and spillway of the sedimentation basin can also pass the 100-year peak flow.

A vegetated drainage corridor will be located downstream of the spillway apron for the sedimentation basin. The vegetated area flows to three existing large diameter culverts beneath Farrington Highway. The vegetated drainage corridor will be modified to construct the stilling basin outlet for the Drainage System. Longer term erosion control measures for the vegetated drainage corridor will be considered during construction of the stilling basin structure.

4.0 SWMP Implementation and Evaluation

This section describes the mechanisms and procedures through which the SWMP will be implemented and evaluated. It identifies the required inspections and follow-up actions and record keeping procedures.

4.1 SWMP Implementation

4.1.1 Inspections

Annual inspections of the landfill area, the drainage system, and the sedimentation basin are performed by WMH personnel. An inspection log is used to document the results of the inspection. The current annual inspection log sheet is presented in Appendix A. After all major rain storm events, inspections of the drainage system, sedimentation basin, and erosion and sediment measures are performed to identify failures, breaches, or sediment deposition requiring repair.

4.1.2 Record Keeping

Records of the inspections and follow-up actions are maintained in the Landfill Operating Record/Files.

4.2 SWMP Evaluation

The effectiveness of the Landfill storm water run-on and run-off drainage systems is reviewed on an annual basis. The review assesses the sedimentation basin, new flow patterns due to changes in grades, the effectiveness of the employed erosion and sediment control BMPs, and compliance with the procedural requirements of the SWMP (inspection, reporting, record keeping, and SWMP updates).

The effectiveness of individual BMPs is assessed using visual observations made during the annual inspections. The inspection log is used to document the effectiveness and appropriateness of the existing erosion and sediment control measures and drainage system features for current site conditions. Maintenance of the sedimentation basin is scheduled on an annual basis and includes removal of any sediment deposits within the sedimentation basin bottom.

4.2.1 Documentation of Revisions

Changes to the SWMP are incorporated through updates of plans and the SWMP. Revisions are reflected within the update log located in Appendix B including the revision date and a brief description of changes.

5.0 References

AECOM. 2010. *Surface Water Management Plan, Waimanalo Gulch Sanitary Landfill, Kapolei, Oahu, Hawaii.* August.

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Earth Tech, Inc. 2009b. *Spill Prevention Control and Countermeasures Plan, Revision 3; Waimanalo Gulch Sanitary Landfill, Oahu, Hawaii.* January.

Waste Management of Hawaii, Inc. (WMH). 2009. *Site Operations Manual*, Waimanalo Gulch Sanitary Landfill, Kapolei, Hawaii. Volumes I and II. November.

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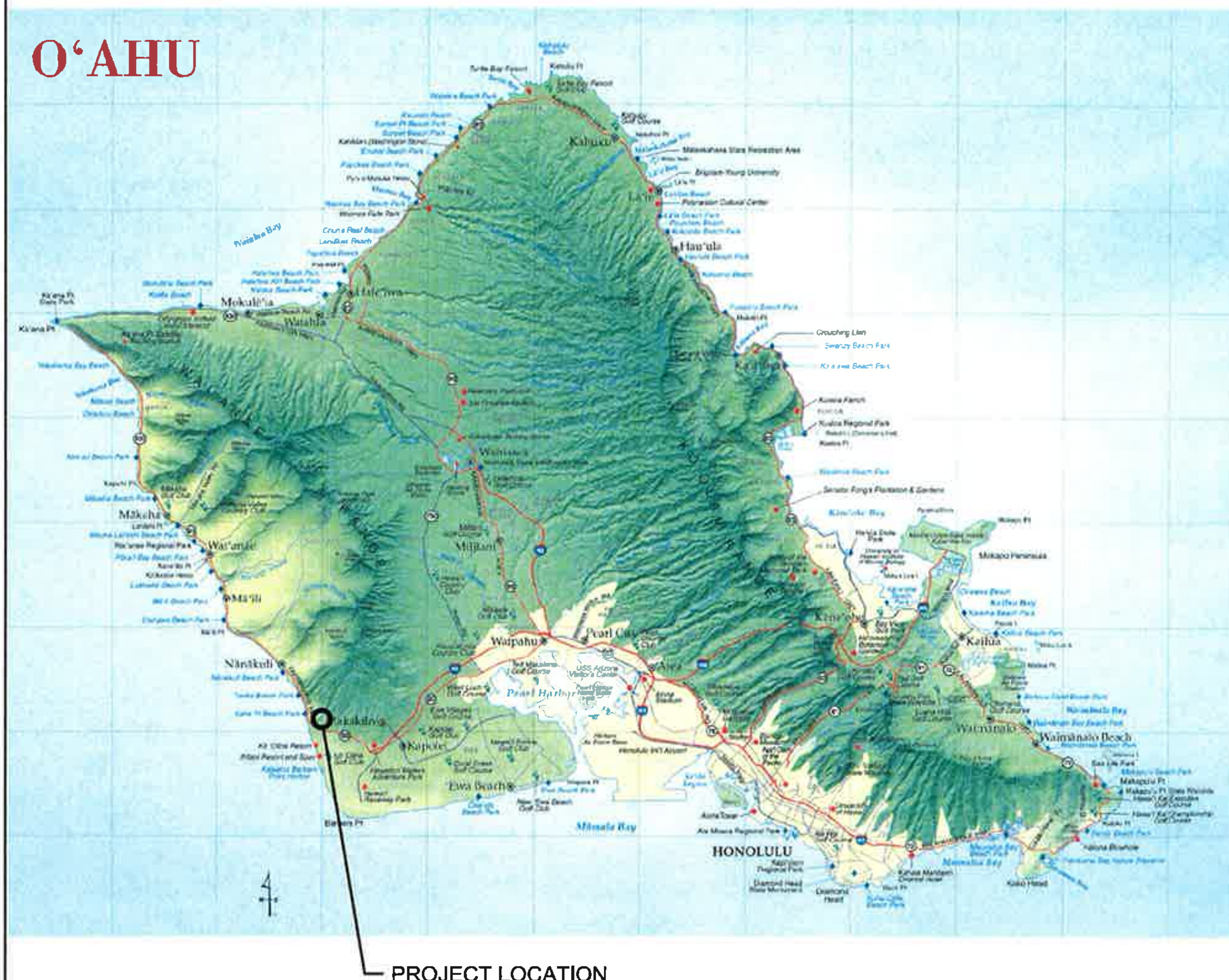
FIGURES

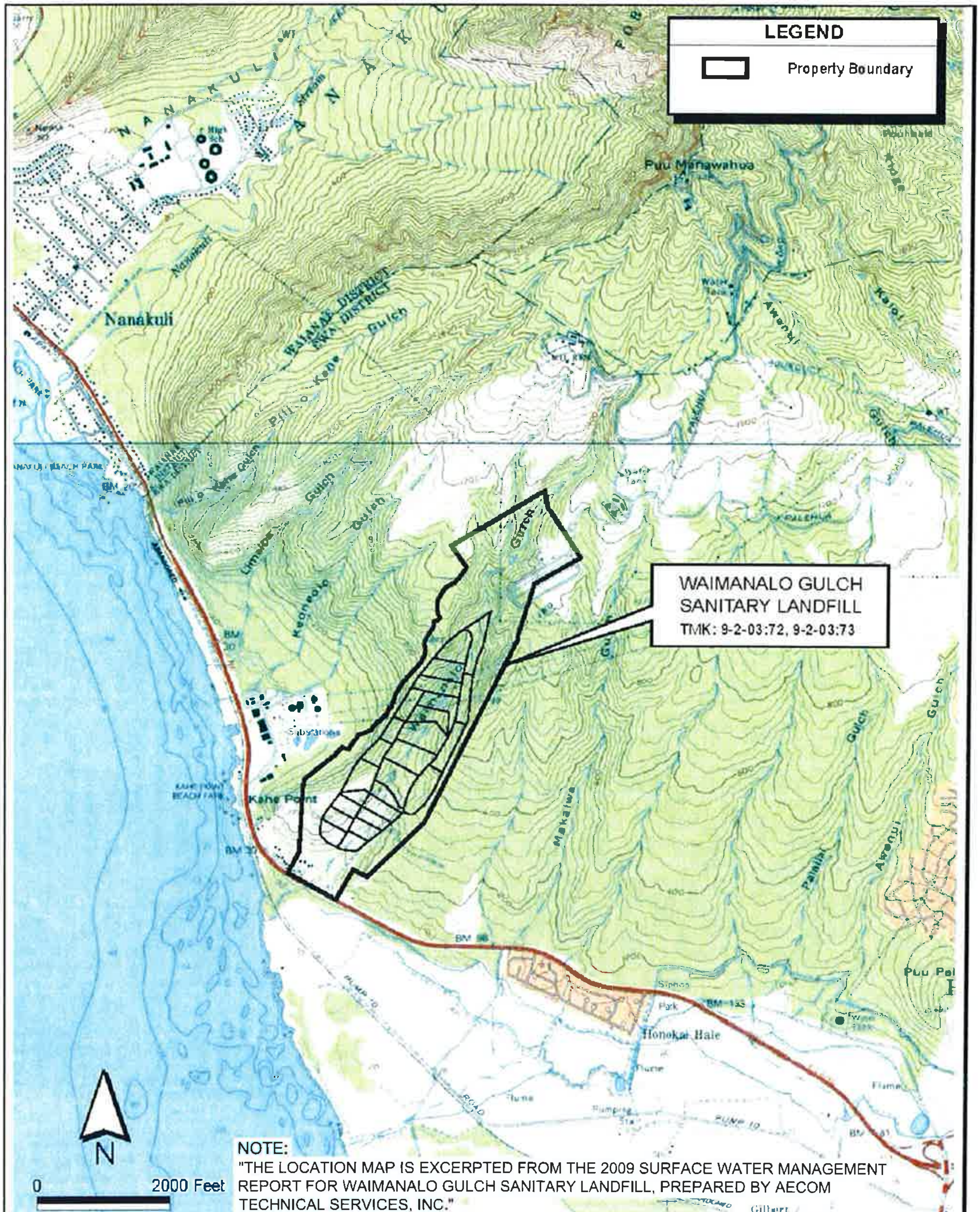
WMH 000620

Figures



WM SWMP Figure 1B 03-08-11 PYM

WM WASTE MANAGEMENT	Oakland California GEI Consultants	WAIMANALO GULCH LANDFILL WESTERN SURFACE WATER DRAINAGE PROJECT EWA BEACH, OAHU, HAWAII PROJECT LOCATION MAP	FIGURE 1

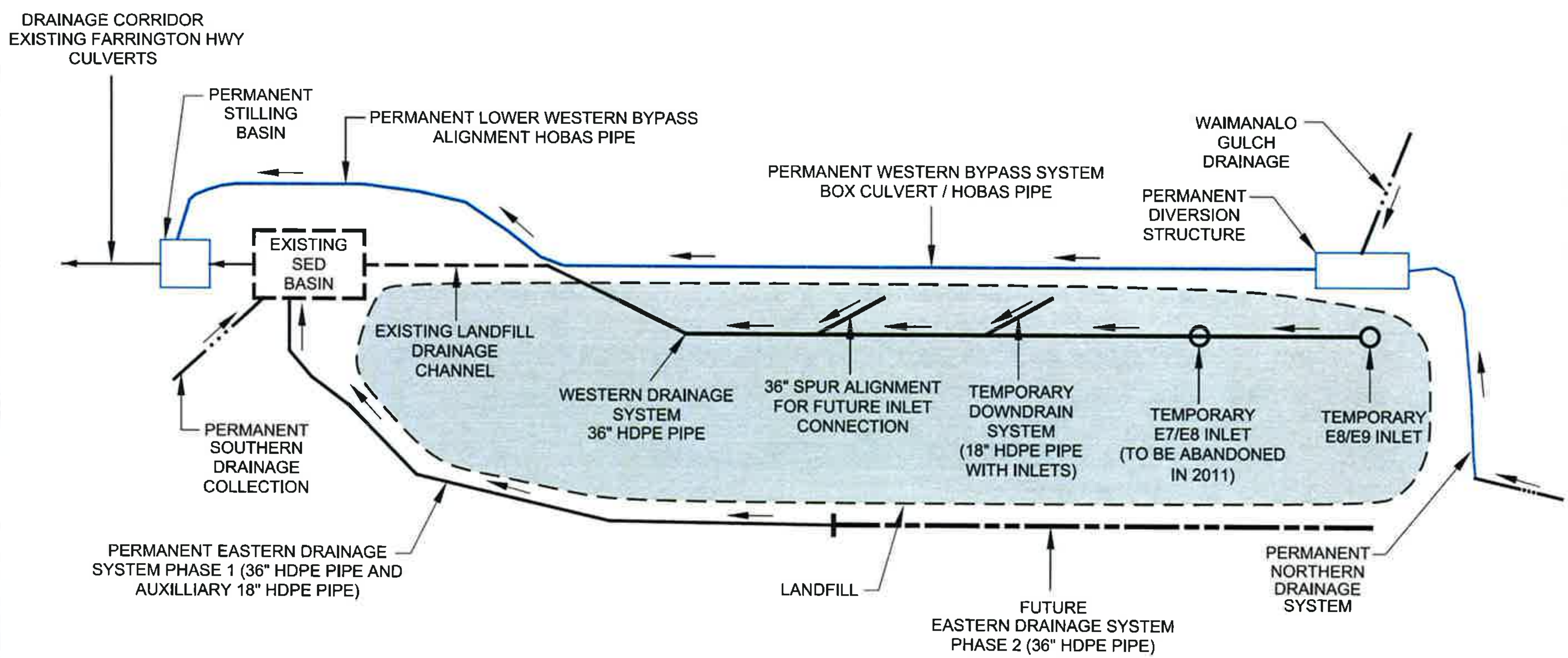


NOTE:
"THE LOCATION MAP IS EXCERPTED FROM THE 2009 SURFACE WATER MANAGEMENT REPORT FOR WAIMANALO GULCH SANITARY LANDFILL, PREPARED BY AECOM TECHNICAL SERVICES, INC."

WM WASTE MANAGEMENT	Oakland • California GEI Consultants	WAIMANALO GULCH LANDFILL WESTERN SURFACE WATER DRAINAGE PROJECT EWA BEACH, OAHU, HAWAII	FIGURE 2
		SITE LOCATION MAP	

WM SWMP Figure 2 03-07-11 PYM

WM SWMP Figure 3 03-11-11 PYM

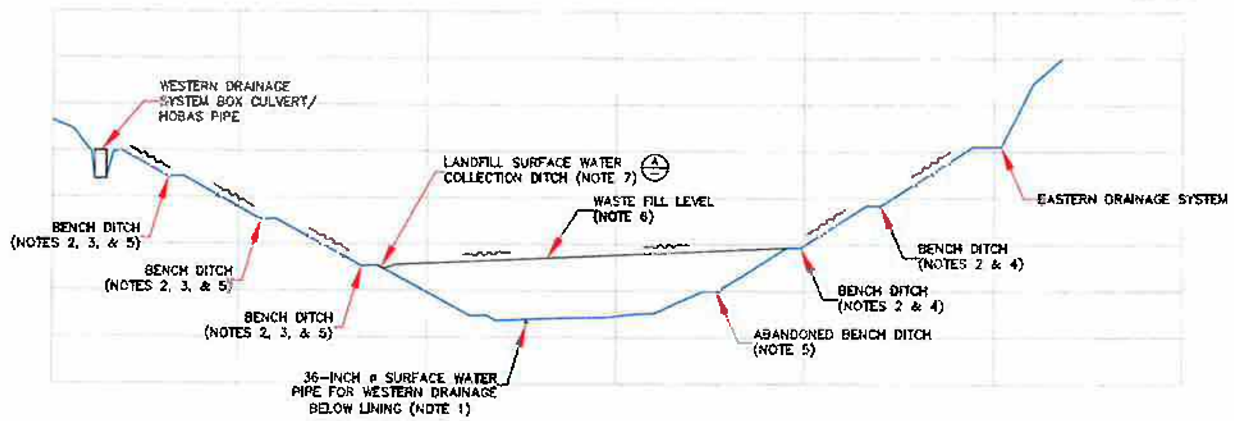


NOT TO SCALE

WASTE MANAGEMENT	Oakland • California GEI Consultants	DESIGNED BY: L. SANSONE CHECKED BY: C. ANDERSON DRAWN BY: P. MORRISON CAD FILE NAME: Figure 3.dwg PROJECT NO. 07018-1 / SCALE: AS SHOWN	WAIMANALO GULCH LANDFILL SURFACE WATER MANAGEMENT PLAN KAPOLEI, OAHU, HAWAII SCHEMATIC OVERVIEW OF SURFACE WATER MANAGEMENT AND CONVEYANCE SYSTEMS

FIGURE 3

STAGE 1 (NOTE 11)



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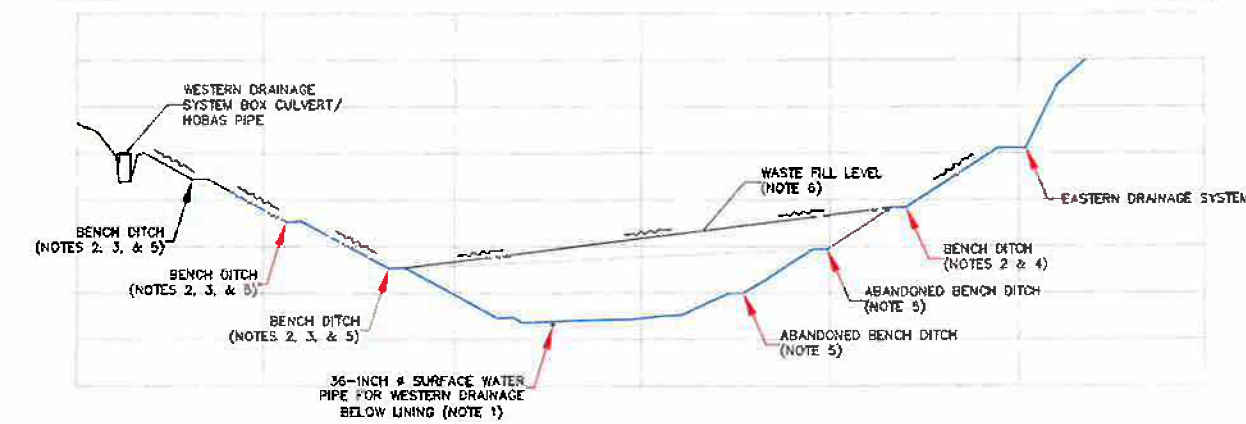
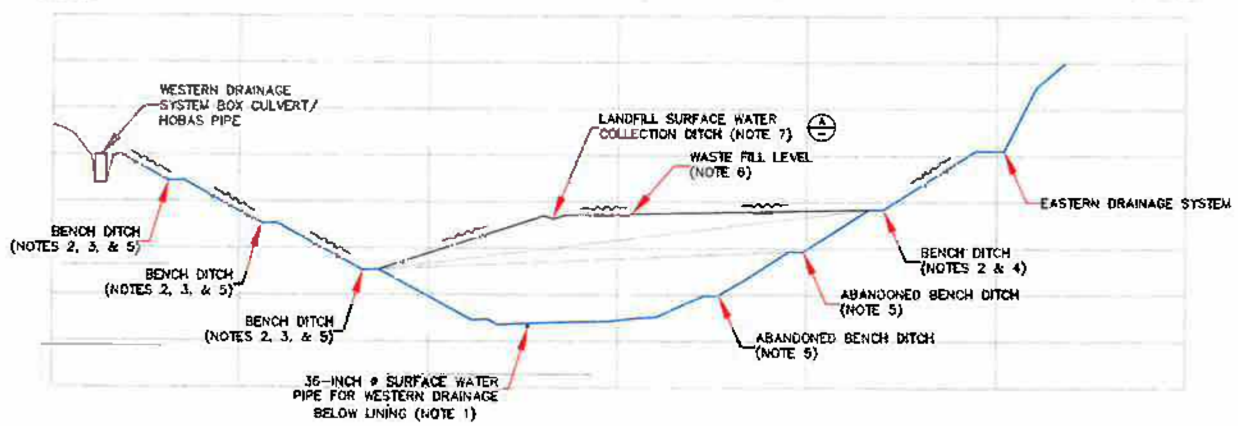
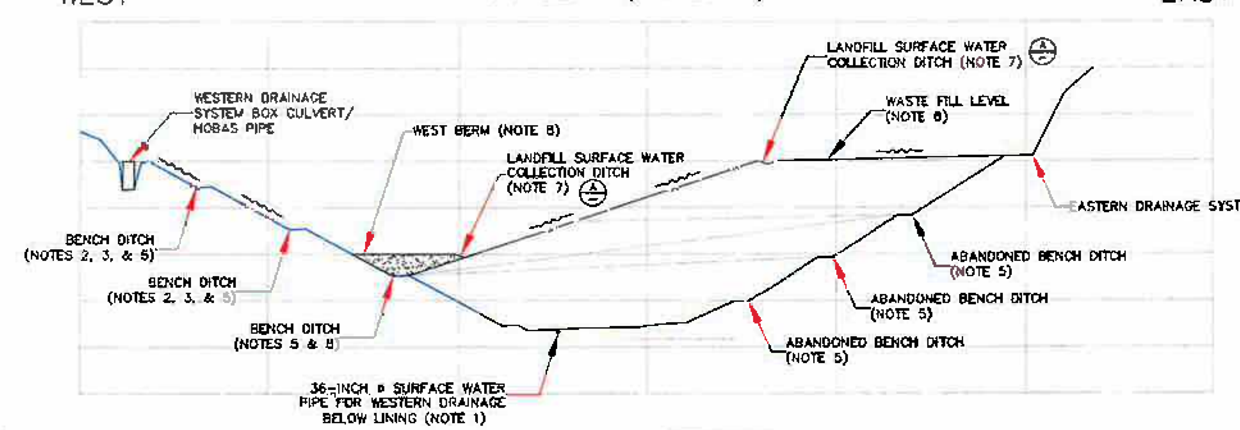


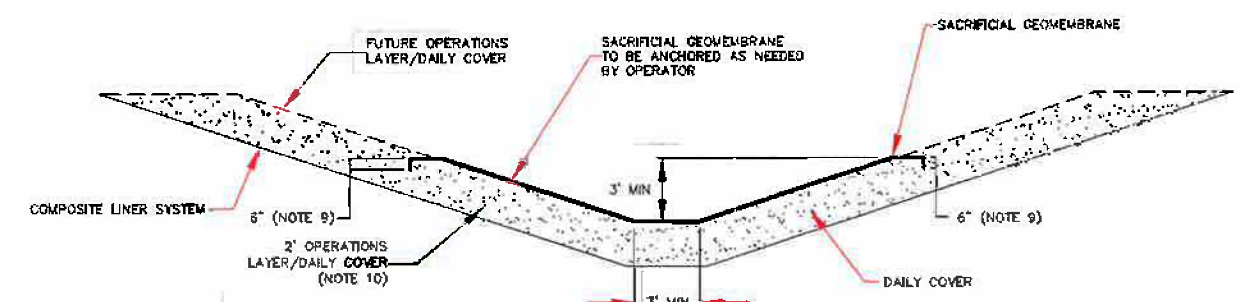
STAGE 3 (NOTE 11)



STAGE 4 (NOTE 11)



SECTIONS
N.T.S.



A — TEMPORARY LANDFILL SURFACE WATER COLLECTION DITCH DETAIL

NOT TO SCALE

LEGEND

~~~ SURFACE WATER RUNOFF

NOTES:

1. CONVEYS WATER COLLECTED AT TEMPORARY INLET E7/E8 OR FUTURE TEMPORARY INLET E8/E9.
2. COLLECTS SURFACE WATER RUNOFF FROM LINED OR UNLINED SLOPES.
3. SURFACE WATER RUNOFF COLLECTED BY DROP INLET AT END OF EACH BENCH, DROP INLETS CONNECTED TO 18-INCH DOWNDRAIN.
4. SURFACE WATER RUNOFF FLOWS TO DROP INLETS AT END OF EACH BENCH WHICH DISCHARGE INTO EASTERN DRAINAGE SYSTEM.
5. DITCH ABANDONED AS WASTE FILL GRADES REACHES BENCH.
6. WASTE FILL LEVEL TO BE BASED ON FILL SEQUENCING PLAN AND SLOPE STABILITY.
7. DITCH FLOWS ON LANDFILL AND WOULD BE MOVED AS NEEDED DURING OPERATIONS.
8. DROP INLETS CONNECTED TO 18-INCH DOWNDRAIN MAY NEED TO BE EXTENDED/ABANDONED AS WEST BERM IS CONSTRUCTED.
9. OPERATOR TO DEPLOY SACRIFICIAL GEOMEMBRANE AND DITCH LINING WITHOUT DAMAGING COMPOSITE LINER SYSTEM OR EXISTING FACILITIES.
10. DITCH MAY EXTEND ONTO WEST BERM.
11. STAGES REPRESENT TEMPORAL SNAPSHOTS OF LANDFILL OPERATIONS FOR ILLUSTRATIVE PURPOSES.

GENERAL NOTE:
SURFACE WATER SCHEMATIC SEQUENCING PREPARED BY GEOSYNTEC CONSULTANTS.

WASTE MANAGEMENT

Oakland • California
GEI Consultants

DESIGNED BY:	Geosyntec Consultants
CHECKED BY:	Geosyntec Consultants
DRAWN BY:	Geosyntec Consultants
CAD FILE NAME:	Figure 4.dwg
PROJECT NO. 07018-1	SCALE: NOT TO SCALE

WAIMANALO GULCH LANDFILL
SURFACE WATER MANAGEMENT PLAN
KAPOLEI, OAHU, HAWAII

LANDFILL INTERIM SURFACE WATER SCHEMATIC SEQUENCING

FIGURE 4

Figure 4 03/11/11 PYM

WMH 000625
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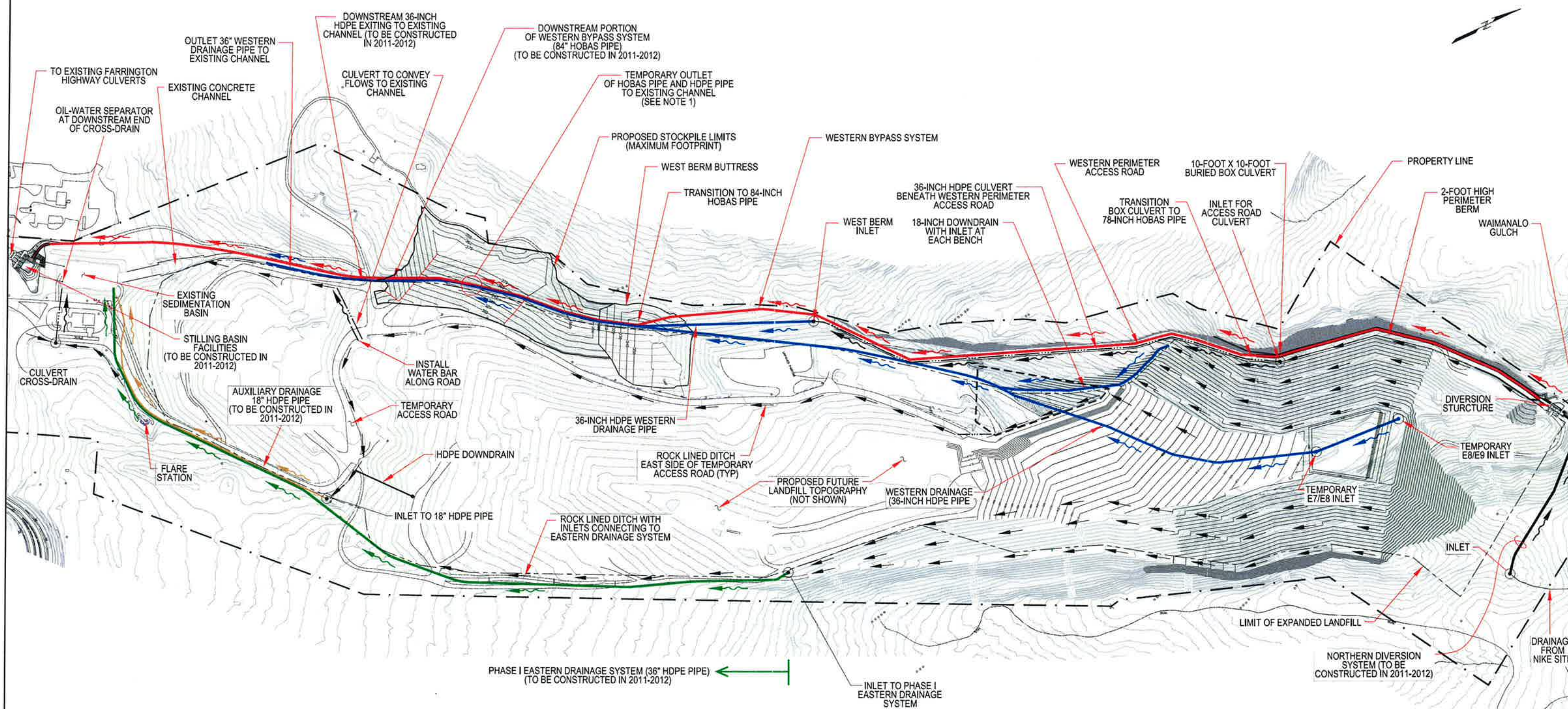


LEGEND

- WESTERN DRAINAGE SYSTEM
- WESTERN BYPASS SYSTEM
- EASTERN DRAINAGE SYSTEM
- NORTHERN DIVERSION
- AUXILIARY DRAINAGE
- DOWNDRAIN
- SURFACE DRAINAGE DITCH
- FLOW DIRECTION (IN APPROPRIATE COLOR)
- INLET STRUCTURE
- CULVERT
- APPROXIMATE LIMITS OF WEST BERM-PHASE 3

PLAN

0 100 200 400 600
SCALE IN FEET

NOTE

1. THE TEMPORARY OUTLETS FOR THE 84-INCH HOBAS PIPE (WESTERN BYPASS SYSTEM) AND 36-INCH HDPE PIPE (WESTERN DRAINAGE SYSTEM) TO EXIT TO EXISTING CONCRETE CHANNEL PRIOR TO PLACEMENT OF THE SOUTHERN STOCKPILE AREA. THE STOCKPILE WILL BE EXPANDED TO THE SOUTH AFTER CONSTRUCTION OF THE DOWNSTREAM PORTION OF THE WESTERN BYPASS SYSTEM AND WESTERN DRAINAGE SYSTEM IN 2011-2012.

WASTE MANAGEMENT

Oakland • California
GEI Consultants

DESIGNED BY:	L. SANSONE
CHECKED BY:	C. ANDERSON
DRAWN BY:	P. MORRISON
CAD FILE NAME:	Figure 6.dwg
PROJECT NO. 07018-1	SCALE: AS SHOWN

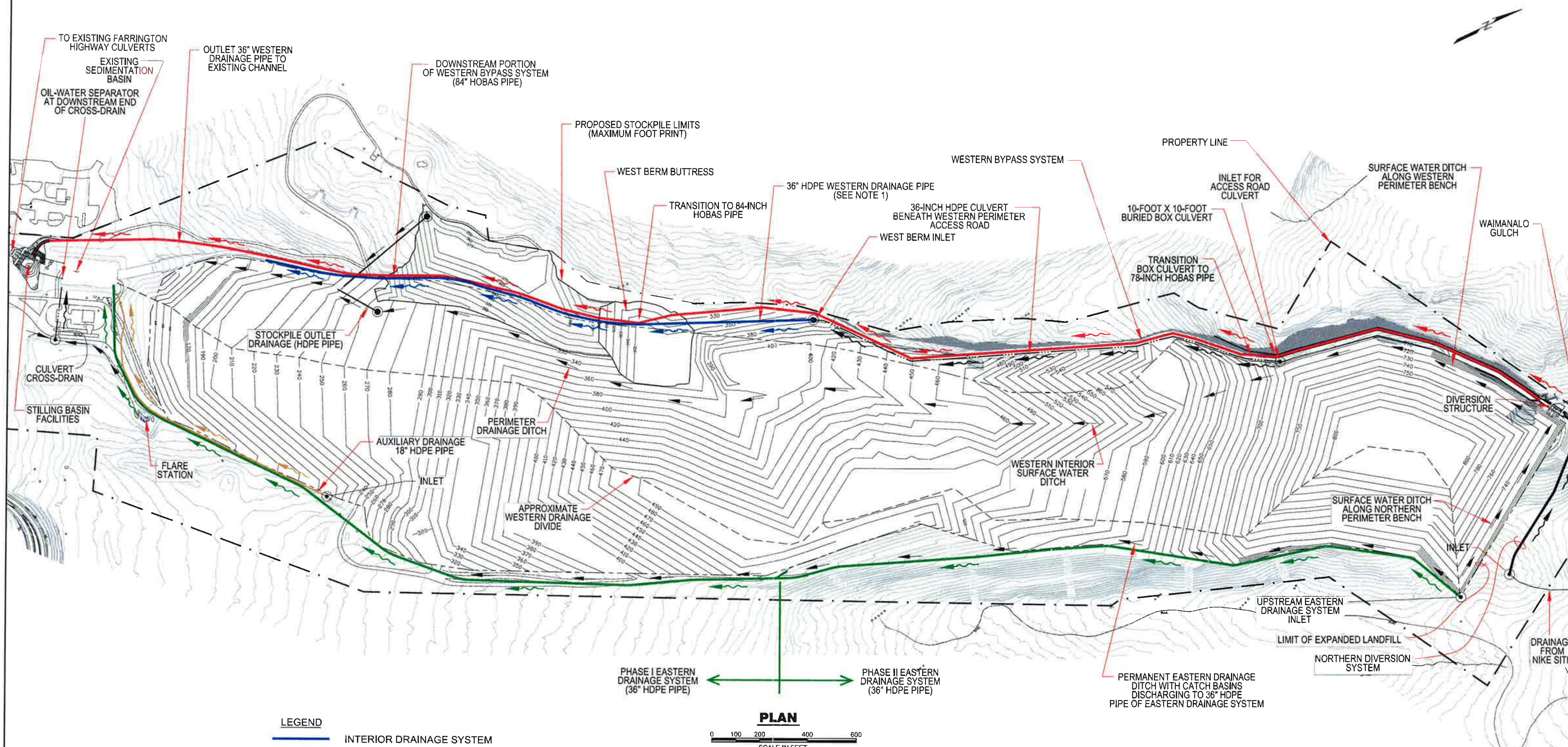
WAIMANALO GULCH LANDFILL
SURFACE WATER MANAGEMENT PLAN
KAPOLEI, OAHU, HAWAII

INTERIM SURFACE RUN-ON AND RUN-OFF CONTROLS

FIGURE 5

Figure 5 03/11/11 PYM

WMH 000626



LEGEND

- INTERIOR DRAINAGE SYSTEM
- WESTERN DRAINAGE SYSTEM
- EASTERN DRAINAGE SYSTEM
- NORTHERN DIVERSION
- AUXILIARY DRAINAGE
- DOWNDRAIN
- SURFACE DRAINAGE DITCH
- FLOW DIRECTION (IN APPROPRIATE COLOR)
- INLET STRUCTURE
- CULVERT

NOTE

1. THE UPSTREAM PORTION OF THE INTERIOR DRAINAGE SYSTEM WILL BE ABANDONED AFTER THE TEMPORARY E8/E9 INLET AND 18-INCH DOWNDRAIN INLETS SHOWN ON FIGURE 5 ARE NO LONGER IN SERVICE.

WASTE MANAGEMENT

Oakland • California GEI Consultants

DESIGNED BY:	L. SANSONE
CHECKED BY:	C. ANDERSON
DRAWN BY:	P. MORRISON
CAD FILE NAME:	Figure 7.dwg
PROJECT NO. 07018-1	SCALE: AS SHOWN

WAIMANALO GULCH LANDFILL
SURFACE WATER MANAGEMENT PLAN
KAPOLEI, OAHU, HAWAII

PERMANENT SURFACE WATER RUN-ON AND RUN-OFF CONTROLS

FIGURE 6

WM SWMP Figure 6 03/11/11 PYM

WMH 000627

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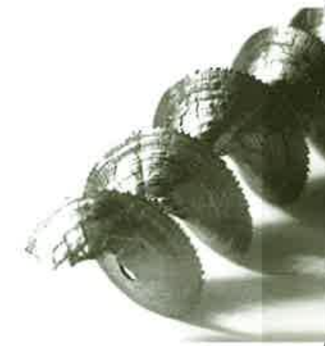
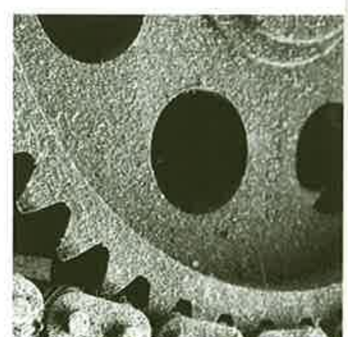


A



WMH 000628

Appendix A

Annual Site Inspection Log

ANNUAL INSPECTION LOG
WAIMANALO GULCH SANITARY LANDFILL
SURFACE WATER MANAGEMENT PLAN

GENERAL INFORMATION

Date:

Personnel:

Weather:

Raining Yes ☐ No ☐

Time Since Last Rainfall Event: No measureable rainfall since June 2010

Runoff:

Flow observed? Yes ☐ No ☐

Type of Flow Sheet ☐ Rill ☐ Concentrated ☐

VISUAL OBSERVATIONS

Inspection List	Yes/No/NA	If Yes, Describe Location and Required Follow-up Action (if any)
Active Face / Landfill Cover		
Bare or sparsely vegetated areas		
Settlement or depressions		
Slope Instability		
Gullies caused by erosion		
Illicitly-dumped material		
Stressed or dead vegetation		
Other indicators of leachate seepage		
Drainage swales		
Evidence of erosion		
Sediment deposition		

Inspection List	Yes/No/NA	If Yes, Describe Location and Required Follow-up Action (if any)
Detention Pond		
Structure blocked or has obstructions		
Outfall areas eroded		
Security Measures		
Landfill access road gate damaged		
Access Roads		
Roads inaccessible		
Roads damaged by erosion or settlement		
Leachate Sumps		
Depth from top of sump less than 3 feet?		
Side Slopes Covered with Geosynthetic Tarps		
Evidence of erosion?		
Geosynthetic tarps intact on lower slopes?		
Geosynthetic tarp condition on lower slopes?		
Side Slopes hydroseeded?		
Upper slopes hydroseeded?		

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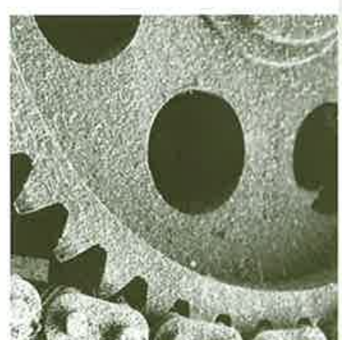
B



WMH 000632

Appendix B

Update Log

UPDATE LOG
WAIMANALO GULCH SANITARY LANDFILL
SURFACE WATER MANAGAMENT PLAN

DATE	DESCRIPTION OF UPDATE	NAME/SIGNATURE OF RESPONSIBLE OFFICIAL
September 2006	The original SWMP prepared in November 2005 has been updated to reflect current site conditions including the current aerial view (Figures 2-3 & 2-4), updated on-site drainage measures plans (Appendix A), the updated hydrology and hydraulic calculations (Appendix B), and the overall watershed hydrology calculations (Appendix C). The SWPCP has been excluded from this version of the SWMP and will be submitted to DOH separately. In addition the 2006 Annual Inspection documentation has been included in Appendix E.	
August 2007	The SWMP has been updated from 2006 to reflect all construction of drainage measures completed to date. Figure 3- 1A and Figure 3-1 B have been updated with the most current topography (March 2007) as well as new drainage features. Surface water hydrology and hydraulic calculations were updated to reflect the changed conditions (Appendix C). The SWPCP and SPCC are both included in the Site Operations Manual that was submitted to DOH, so therefore they are not included in this SWMP.	
August 2008	The SWMP has been updated to reflect the most recent topographic conditions (May 2008) and site drainage features updated during 2007. Figure 3-1A and Figure 3-1 B have been updated with the most current topography (May 2008). Also surface water hydrology and hydraulic calculations were updated to reflect the changed conditions (Appendix B). The SWPCP and SPCC are both included in the Site Operations Manual that was submitted to DOH, so therefore they are not included in this SWMP.	
August 2009	The SWMP has been updated to reflect the most recent topographic conditions (March 2009) and updated site drainage features. Figure 3-1A and Figure 3-1 B have been updated with the most current topography (March 2009). Also surface water hydrology and hydraulic calculations were updated to reflect the changed conditions (Appendix B). The SWPCP and SPCC are both included in the Site Operations Manual that was submitted to DOH, so therefore they are not included in this SWMP.	
August 2010	The SWMP has been updated to reflect the most recent topographic conditions (May 2010) and updated site drainage features. Figure 3-1A and Figure 3-1 B have been updated with the most current topography (May 2010). Surface water hydrology and hydraulic calculations were updated to reflect the changed conditions (Appendix B). An update to the SWPCP was submitted with the recent NPDES NOI-B permit application responses to DOH comments (June 2010). The SPCC is excluded from this submittal.	
March 2011	THE SWMP has been updated to reflect current and proposed site drainage features to control site run-on and run-off at the landfill. Both interim and permanent surface water management features were described in the update along with figures showing the locations of these features.	

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